AUSTRALIAN SOCIETY FOR LIMNOLOGY

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LIMNOLOGY NEWSLETTER

Volume 24. Number 2. July 1986

The Australian Society for Limnology is an association of over 400 people with professional or amateur interests related to Australian inland waters. Since its inception in 1961, the Society has played an important role in fostering limnology work in this country. The ASL promotes liaison between limnologists in academic, private and governmental institutions and has a vested interest in the conservation of aquatic and related resources. Annual conferences are held near centres of limnological interest, and the programme includes scientific sessions, field excursions and social activities.

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Deadline for Next Issue: September 12

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LAST CHANCE TO CONSERVE PRISTINE RIVERS IN EAST GIPPSLAND

Recently released draft recommendations from the Victorian Land Conservation Council (LCC 1986) on land use in East Gippsland are exceptional in taking into consideration, for the first time, the need to conserve undisturbed reference catchments. The LCC is a statutory body which makes recommendations to the Minister for Planning and Environment about the use of public land in Victoria. The drafting recommendations are currently open for public comment, and are coming under strong criticism from Timber Industry interests. It is essential that limnologists from all states actively support the LCC recommendations which conserve rivers and streams.

East Gippsland, in the far eastern portion of Victoria, is the only part of the state where, to the delight of lotic (and lentic) researchers, a significant number of streams (and a few lakes) are still in an essentially natural condition. In all there are 33 catchments (order 3 or 4 in size) where there are no dams, no agriculture, little (ie 10%) or no logging, and few roads (Macmillan 1985). At least 17 of these catchments are also free of exotic pest species such as trout. In fact many of the East Gippsland rivers are noteworthy for their lack of exotic fish species, something that cannot be said for most of the state's rivers. Many are also in a relatively undisturbed condition, forestry exploration being the most widespread landuse (Blyth and Jackson 1985).

Currently 11 of the pristine catchments are protected, 10 within Croajingalong National Park. These protected catchments include a number of small coastal streams and landlocked coastal lakes. Among the unprotected catchments, a number of distinct types not currently represented within reserves are distinguishable. They include: low gradient, high elevation streams of the Errinundra Plateau; high gradient streams associated with the plateau escarpment (Blyth 1984, Macmillan 1984); two major east flowing tributaries of the Snowy River, the Rodger River (194km^2) and Mountain Creek (238km^2), the two largest untouched catchments in East Gippsland; a number of other upland streams draining both granitic and sedimentary catchments; and Dock Inlet, a coastal freshwater lagoon separated from the sea by a sand barrier.

The LCC's draft recommendations conserve representative examples of all of the region's stream types (stream types being distinguished on the basis of catchment physiography, rainfall and geology (see Macmillan 1984), bringing the total number of protected pristine catchments in East Gippsland to 24. The additional 13 catchments are protected within four major park proposals: the Snowy River National Park addition (3 catchments including the Rodger River and Mountain Creek); the Errindundra National Park (5 catchments); the Coopracambra-Kaye National Park (1 catchment, Dock Inlet). These representative catchments are of at least regional and state significance (see significance criteria in Macmillan in press).

There is at least one glaring omission in the LCC's recommendations, and that concerns the Betka River, a coastal catchment. Due in part to the efforts of ASL, this catchment was put onto the Register of the National Estate some years ago. At that time the catchment was pristine. Over the last few years parts of the catchment which lie outside Croajingalong National Park have been logged, though as yet not intensively. It is disappointing to yet again see inappropriate activities being conducted by state instrumentalities in National Estate areas.

Written submissions to the LCC are due by 15 July 1986, after which final recommendations will be developed. There is no guarantee that the final recommendations will be as good as the draft ones, so at this stage it is crucial that limnologists write in supporting the recommendations.

Submissions should be sent to:

The Secretary
Land Conservation Council
4th Floor, 464 St Kilda Road
MELBOURNE VIC 3004

If you miss 15 July, please address comments to:

The Hon John Cain
Premier of Victoria
1 Treasury Place
MELBOURNE VIC 3002

The Hon Joan Kirner
Minister for Conservation, Forests and Lands
240 Victoria Parada
EAST MELBOURNE VIC 3002

The Hon Jim Kennan
Minister for Planning and Environment
500 Collins Street
MELBOURNE VIC 3000

If you want further information on East Gippsland rivers please contact Luisa Macmillan, Department of Planning, Policy and Landscape, RMIT, GPO Box 2476V, Melbourne, 3000, ph (03) 660 2226.

REFERENCES

LCC (1986) East Gippsland Area Review: Proposed Recommendations, Land Conservation Council: Melbourne - copies of this report are available free on request from the LCC ph (03) 267 1311.

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TWENTY - FIFTH CONGRESS ABSTRACTS

WATER QUALITY AND TROPHIC STATUS OF TWO DUNE LAKES USED FOR RECREATION

Dr Angela H. Arthington, School of Australian Environmental Studies, Griffith University, Nathan, Queensland, 4111.

Freshwater lakes within the Cooloola National Park and on Moreton Island provide valuable natural areas for recreation within south-east Queensland. Despite the recreational value of dune lakes there are no data on the impacts of recreation on their water quality, algal communities and trophic status. This paper describes a study of Lake Freshwater at Cooloola and Blue Lagoon on Moreton Island carried out during 1983-85 under funding from the Queensland National Parks and Wildlife Service. Both lakes were found to have the basic physico-chemical characteristics in common to the the acid dune lake series. However, the mean concentration of total phosphorus was higher in Lake Freshwater (12.1 $\pm$ 3.3 ug/l) than in Blue Lagoon (6.0 $\pm$ 2.6 ug/l). The low concentrations of K, Mg, Cl and SO_4 ions, indicate that atmospheric accession from seawater is the major source of phosphorus in this lake. In Lake Freshwater, the higher concentration of phosphorus and the ratios between phosphorus and major ions suggest an additional source of phosphorus input. The paper will discuss possible sources or phosphorus with particular reference to recreational activities at Lake Freshwater. Data on algal biomass and community composition will also be presented and the relationship between total phosphorus and chlorophyll-a is examined. Other indicators of recreational impacts will be discussed (e.g. concentrations of trace metals, indicators of human faecal contamination).

MACROBENTHIC DIVERSITY IN A FORESTED UPLAND STREAM

L.A. Barmuta, Dept of Zoology, Monash University, Clayton, Victoria 3168

All habitats at a single site on the Acheron River (nr Narbethong, Vic.) were sampled regularly for one year. Mean species richness for the whole site showed no consistent seasonal pattern. Spatial and temporal patterns were examined in more detail by clustering the 150 samples into eight groups using TWINSPAN. Species richness increased with increasing sediment size amongst these groups. Diversity was examined by constructing species abundance curves for each group. Most variation was exhibited by the frequency of singleton and doubleton species, but there were no systematic patterns related to either season or habitat type. Both the lognormal and logseries distributions fitted these empirical data approximately, and the diversity index a (derived from the logseries) merely reiterated the trend shown by species richness. As the TWINSPAN groups were aggregated, the species abundance curves became more lognormal. This casts doubt on assertions by some ecologists that deviation from the lognormal

indicates disturbance or loss of "equilibrium". The data from this site indicate lognormality can only be demonstrated unequivocally in very large samples (20,000 individuals) and suggests that diversity is a weak discriminant of community structure in this system.

A SAMPLING DEVICE THAT QUANTITATIVELY COLLECTS BENTHOS IN FLOWING OR STANDING WATERS

A.J. Boulton, Zoology Dept, Monash University, Clayton, Vic. 3168

A hand-operated suction sampler designed to sample benthos from fine to coarse rocky substrate in standing and flowing waters is described. This sampler collected a similar number of taxa, but more individuals from a flowing riffle than did a modified Surber sampler. The suction sampler is suitable for quantitative studies on streams which have rocky substrata and highly variable discharge or intermittency - such streams are especially common in Australia.

LAKE CHISHOLM, A POLYHUMIC FOREST LAKE IN TASMANIA

L.C. Bowling, Department of Botany, University of Tasmania
Present address: Department of Botany, University of New England

Physico-chemical studies of Lake Chisholm showed it to be of the warm monomictic type. The dominant feature was its extremely high humic content, causing the rapid attenuation of almost all solar radiation in the surface one metre, and leading to marked thermal stratification for nine months of the year. Anoxia develops in the hypolimnion, and even in winter circulation is sluggish. The water was acidic, with an ionic dominance resembling dilute seawater, despite the lake's formation in a karstic depression. The phytoplankton consisted predominantly of flagellates, especially Chrysophyceae, which at times form virtually monospecific blooms. However, little structured phytoplankton succession was evident, and lack of this is explained in terms of the lake's mid-latitude location and mild maritime climate.

ARTIFICIAL WETLANDS FOR WASTEWATER TREATMENT : THE INFLUENCE OF SELECTED EMERGENT AQUATIC MACROPHYTES ON SYSTEM PERFORMANCE

Breen, P.F. and Chick, A.J. CSIRO Centre for Irrigation Research, PMB, Griffith NSW 2680

Natural and artificial wetlands have been shown to have significant potential as a low-cost wastewater treatment alternative. A glasshouse trial was conducted on experimental artificial wetlands to assess the influence of various wetland plant species on system performance. Systems planted with Baumea articulata, Eleocharis sphacellata, Juncus ingens, Phragmites australis Schoenoplectus validus and Typha

orientalis were compared with respect to their abilities to remove TP and TN from poultry rendering plant wastewater. All species showed good nutrient removal potential. Data is presented on nutrient load reductions and system water use via evapotranspiration. Aspects of species selection for artificial wetland systems are discussed in terms of system management and various wastewater treatment objectives.

THE HEART BEAT OF A RESERVOIR

Frank L. Burns, Consulting Engineer, Glen Waverley, Vic.

In common with many other Limnologists the author has been guilty of regarding changes in the temperature profile through the depth of a lake or reservoir as something which happens on a slow moving seasonal cycle. We visit the reservoir weekly or monthly to measure the temperature at various depths, and then draw nice smooth lines through the plotted points to produce attractive looking seasonal isotherms for the reservoir. Are we missing something by this simplification of the temperature changes which take place in a reservoir?

During the past summer the author has installed and operated several fully automatic artificial aeration installations in Victorian reservoirs. These consist of electric compressors pumping air to diffusers in the bottom of the reservoir, with the controls linked to temperature probes at different depths to switch the compressor on automatically when the temperature gradient (thermal stratification) in the reservoir exceeds a predetermined critical value.

This requires the continuous measurement of the temperature profiles, and special equipment has been installed to record these temperatures. The paper will discuss the results of these recordings, which show the extremely dynamic and fast moving nature of these temperature changes, and the short term cycling which could be described as the 'heart beat of the reservoir'.

LIFE HISTORIES OF FOUR SPECIES OF COLOBURISCOIDES (EPHEMEROPTERA): OLIGONEURIIDAE IN SOUTHEASTERN AUSTRALIAN STREAMS

Ian C. Campbell, Water Studies Centre, Chisholm Institute of Technology, East Caulfield, Vic.

Coloburiscoides nymphs are common filter feeders in stony upland streams of Southeastern Australia. The life histories of the three described and one undescribed species (a total of five populations) were investigated over a three year period. The development time was variable between years. Coloburiscoides giganteus required 16 or 28 months to complete development, with a seven to eleven month egg or early nymphal diapause. Coloburiscoides munionga had two cohorts arising from adults emerging in spring and summer and each requiring a

year to complete the life cycle. Coloburiscoides haleuticus was investigated at two sites. At both sites the emergence period was extended (8-9 months) with a peak emergence in spring. Nymphal development was variable requiring from six to fifteen months. An unnamed species of Coloburiscoides also had a long emergence period with nymphal development taking about a year.

THE USE OF FLOW INJECTION ANALYSIS FOR THE DETERMINATION OF THE NUTRIENT STATUS OF ESTUARIES OF LARGE LAKES

Lesley Clementson
CSIRO Division of Fisheries Research, Hobart.

Flow injection analysis (FIA) is a relatively new technique for automating chemical analysis; it has been used successfully for the determination of nitrate/nitrite and phosphate based on traditional colorimetric methods.

Unlike Auto Analyser techniques where samples are segmented by air bubbles, FIA is based on the injection of a sample into a continuously flowing stream of reagent. This allows FIA to offer the advantages of smaller sample size, lower reagent consumption and increases in sample handling compared with the Auto Analyser methods.

Work done in the Storm Bay/Derwent River area has shown the FIA technique to be extremely well suited for work on board a small vessel. Nutrient results from this work will be presented and the potential for analysing nitrate, nitrite, or phosphate while underway will be discussed.

THE POPULATION DYNAMICS OF DAPHNIOPSIS PUSILLA (CLADOCERA: CRUSTACEA) IN AN EPHEMERAL SALINE POND

Peter Davies, University of Western Australia

The population dynamics of the Crustacean group Cladocera typically consist of a number of clonal generations culminating in a single sexual generation. The initiation of sexual reproduction has generally been attributed with the onset of environmental stress.

A salt tolerant cladoceran Daphniopsis pusilla, is endemic to, and dominates a series of saline ponds at Rottnest Island, Western Australia. These become hypersaline and inhospitable during the summer months and the environmental cue responsible for the change from asexual to sexual reproduction was suggested to be high salinity. However, an intensive study of the population dynamics of D. pusilla a one pool revealed no correlation of high salinity with the onset of sexual reproduction and no temporal segregation of the different reproductive modes. These results will be discussed in the context of current theories on the different ecological roles of asexually and sexually derived offspring.

THE GULF OF CARPENTARIA, ONCE THE LARGEST LAKE IN AUSTRALIA

DE DECKKER, Patrick (Geography, Monash Univ.), CHIVAS, Allan, and SHELLEY, Michael (RSES, ANU), TORGERSEN, Tom (Marine Sciences, Univ. Connecticut, USA

Magnesium and strontium analyses of ostracod shells recovered from two cores taken in the Gulf of Carpentaria permitted reconstruction of the salinity of the waters in which the ostracods grew. Approximately 40,000 years ago, when sea level was well below that of today, the Gulf of Carpentaria was separated from the sea, and a gigantic lake occurred there. Trace element (Mg, Sr) analyses of ostracod shells indicate that water in "Lake Carpentaria" was fresh to slightly saline and remained so for most of the time until sea level rose above the lake floor, thus causing the sea to transgress the lake approximately 13,000 years ago.

This study of trace elements (Mg, Sr) of ostracod shells demonstrates the possibility to reconstruct accurately past salinity fluctuations and water temperatures, especially if stable isotope studies of ostracod shells are also carried out. Applications of these techniques to reconstruct past salinity levels, like for the River Murray for example, are discussed.

ADVECTION AND THERMAL STRATIFICATION IN LAKE BURRAGORANG (NSW)

J.M. Ferris, Australian Antarctic Division, Department of Science and Technology, Channel Highway, Kingston, Tas 7150

Lake Burragorang is a deep (105m), essentially warm monomictic lake with a median bulk retention time of 1.8 years. Inflow volume is upredictable seasonally and annually, and retention times ranged from 0.5 to 22.0 years between 1961 and 1980. Thermal and oxygen stratification are profoundly influenced by inflow/outflow relations. A comparison of monthly mean profiles of temperature and dissolved oxygen from wet and dry year groups reveals that advective processes increase the summer heat income and help to distribute heat more deeply into the water column. Subsequently, these processes increase the rate of autumnal heat loss, yielding an almost equal winter heat content and effectively increasing the annual heat budget by 22% of the dry year budget. The downward movement of heat is found to be most closely related to the volume of water subtracted through the sub-surface offtake, rather than to the volume of influent water. The summer maximum of Schmidt stability is lowered by only 1% in wet years, but autumnal stability is lowered by up to 33% while, in winter, stability is enhanced by 100% of the dry year stability. The volumetric hypolimnetic oxygen depletion rate is approximately doubled in wet years.

MICROSCOPIC, AQUATIC ORGANISMS:- DOES SMALL IMPLY SIMPLE?

G.C. Gant, Botany Department, University of Adelaide, Adelaide, South Australia 5001

The biology of aquatic, microscopic organisms (bacteria, phytoplankton and zooplankton) is examined in an attempt to demonstrate that these small apparently simple organisms are indeed highly complex with well developed strategies for growth and survival.

ON MEANS AND VARIANCES AND THE PROPERTIES OF AQUATIC FOOD CHAINS

Graham P. Harris, CSIRO Marine Laboratories, Hobart, Tasmania

When samples are taken from any body of water a number of sources of "error" are apparent. These "errors" arise from horizontal and vertical advection, from biological dynamics and from analytical errors. The first three sources of "error" are often lumped together and called "sampling error" and the conventional wisdom is to try to remove the variance associated with this and to try to "sanitize" the data. In fact this throws the baby out with the bath water and removes a significant source of information. The variances in data sets are more informative than the means and reveal information about the coupling of physical and biological processes in aquatic food chains. Time lags of anything up to three weeks are characteristic of the biological response to fluctuating physical processes so simple correlations between means are invalid. As most aquatic food chains are classic examples of non equilibrium systems, ensemble means frequently carry little information except some indication of the central tendency in the data. Examples from various lakes will be given.

BEHAVIOUR OF COPPER, MANGANESE AND ZINC ADDED TO PLASTIC ENCLOSURES PLACED IN ISLAND BILLABONG

B.T. Hart, N.A. Currey & M.J. Jones, Water Studies Centre, Chisholm Institute of Technology, Caulfield East.

Large plastic enclosures (5m diam, 3m deep) placed in Island Billabong were used to study the cycling of copper, manganese and zinc over a six week period. Copper was added to one enclosure, and manganese and zinc to another, at initial concentrations around ten times the natural wet season values. All three metals were rapidly removed from the water column, such that by the end of the six week period, the concentrations in the enclosures were back to approximately the pre-spike values. Uptake by phytoplankton, followed by sedimentation was the major (65%) copper removal process. Manganese and zinc, added together, were found to influence each other. The major manganese removal process (65%) by bacterial oxidation and sedimentation of the product was rapid (ca. 3 days). The other removal pathway involved adsorption of the manganese (and zinc)

to existing pariculate matter. Approximately one third of this adsorbed manganese (10% of the total added) appeared to undergo delayed oxidation some 8 days after the initial additions, and the heavier particles settled out more rapidly.

The remainder of the manganese (25% of the total) subsequently settled out more slowly. Three days after the addition, all the manganese had been converted from ion-exchangeable to particulate forms. The zinc removal process was complex. The major removal pathway (60%) involved very rapid initial association with suspended particulate matter followed by rapid removal after a 7-8 day lag period. These zinc-suspended matter complexes appear to also contain the manganese that underwent delayed oxidation; it is possible the zinc exerted a toxic effect on the bacterial population to cause this delay. A further 25% of the zinc was removed in association with phytoplankton. The sudden bursts in the phytoplankton activity, a feature of these tropical billabongs, appears to be an important mechanism for removing copper and zinc from the water column.

THE INFLUENCE OF ARTIFICIAL AERATION ON WATER QUALITY AND THE SEASONALITY OF THE PLANKTON OF A SMALL TROPICAL RESERVOIR

Peter Hawkins, Botany Department, James Cook University, Townsville, 4811

Artificial destratification in 1984 produced significant changes in the composition and seasonality of the limnoplankton compared with previous years. Prior to artificial destratification, seasonal circulation and stratification of the reservoir was a dominant influence on water chemistry and the phytoplankton composition. The periodicity of the dominant phytoplankters was directly related to reservoir hydrodynamics. Homogenisation of the water column, induced by artificial aeration, damped the previously observed seasonal fluctuations in the biological and chemical parameters of water quality. The high biomass concentrations characteristic of algal blooms were ameliorated by circulation and dilution throughout the water column. Nevertheless there was a considerable increase in mean algal standing crop as consistent mixing allowed the development of a diatom (Synedra ulna) dominated flora, which appeared to be regulated by silica availability. The seasonal decline in the ratio of mixed depth to photic depth during the destratification period altered the composition of the lesser dominant species in favour of the Chlorophyceae. The influence of artificial aeration in suppressing the growth of filamentous cyanobacteria probably contributed to the increased abundance and diversity of the cladoceran fauna in 1983-84.

BILLABONG MACROINVERTEBRATES IN RELATION TO HABITAT

Terry Hillman, Peter Till Laboratory, Albury-Wodonga Development Corporation

Macroinvertebrates were sampled from several habitats (including aquatic plants, open water, and logs) in two River Murray billabongs. As well as differences between habitat types, the data also indicated that the composition of communities utilising similar habitat types differed between billabongs. Adaptations of floodplain organisms, including the utilisation of environmental mosaics, are discussed as are the implications for studies oflife history strategies.

THE TEMPORAL VARIABILITY OF AQUATIC PLANT COMMUNITIES ALONG THE SWAN AND APSLEY RIVERS, TASMANIA.

Jocelyne M.R. Hughes, Dept. of Geography, University of Tasmania, Box 252c, Hobart

Fourteen permanent sample plots were established in February 1984 along the Swan and Apsley Rivers, in order to monitor the changes in structure and species composition of lotic plant communities, and their relationships with hydrological events. The sites were chosen from a variety of environments, including permanently flowing and periodically inundated sections of the river channel. The hydrological data showed strong temporal variation with Cv of monthly lows = 1.39 and 0.98, and the Cv ot monthly peaks = 0.75 and 0.58 for the Apsley and Swan Rivers respectively. The temporal changes in abundance, diversity and structure of the communities indicated a seasonal pattern of aquatic plant growth in early summer and decomposition in late autumn, with induced population fluctuations after a high or low flow event. The variability of hydrological events along both rivers allows the coexistence of a relatively high number of species with a high degree of polydominance.

GEMINATION ECOLOGY OF TYPHA SPP

Jane Roberts, University of Adelaide

Water availability and salinity were identified as critical and characteristic factors of the regeneration niche of Typha spp. The effect and relative importance of these two factors was investigated in laboratory experiments using seeds from up to eight localities in south-east Australia. These results, combined with data from previous studies on resource allocation, suggest that Typha fits the spatial disperser syndrome described by Angevine and Chabot (1979).

PARTICLE CAPTURE BY DAPHNIA: EVIDENCE FROM HIGH-SPEED MICROCINEMATOGRAPHY, SEM AND TEM

Russell J. Shiel & George G. Ganf, Botany Department, University of Adelaide, Box 498 GPO Adelaide, SA 5001

Preliminary feeding experiments using Daphnia carinata s.l. and examining particle distribution on the limbs of dissected animals suggested that trunk limbs III and IV were not functioning as sieves as historically accepted. Trunk limb II appeared to be the primary capture site. In living Daphnia, limb beat rate (20Hz) precludes discrimination by eye; 16 mm high-speed cinematography was used to examine particle handling. Scanning and transmission EM also were used to determine limb ultrastructure and locate musculature which may help explain observed capture/rejection movements. The latter also may aid in locating neural connections which could be involved in discriminatory particle selection.

TAXONOMY AND MORPHOLOGICAL VARIATION IN THE CHERAX DESTRUCTOR GROUP

Anthony Sokol, Department of Zoology, Monash University, Clayton, Victoria 3168

The taxonomy of the genus Cherax has been the source of considerable confusion, particularly with respect to species in Riek's (1969) destructor group. This group includes four species, viz. C destructor, C. albidus, C. davisi and C. esculus. The present study involved a comprehensive morphological investigation of these taxa using bivariate (Analysis of Covariance) and multivariate (Principal Components Analysis) techniques. These analyses did not support distinction of C. esculus or C. davisi from C. destructor. They did, however, indicate that C. albidus and three outgroup species (C. rotundus, C. punctatus and C. dispar) are morphologically distinct from C. destructor. The analyses also suggested that the divergence of C. albidus and C. destructor may have involved heterochronic change.

ION EXCRETION SITES IN Tanytarsus barbitarsis Freeman, A HALOBIONT CHIRONOMID

M.J. Kokkinn, Department of Zoology, The University of Adelaide

T. barbitarsis is a halobiont chironomid which inhabits saline waters up to 170 gl^{-1} in concentration across southern Australia. It is able to maintain its body fluids at approximately one third seawater by excreting excessions. The sites of ion excretion were investigated in the embryo, the larva and the pupa using a silver staining technique. Results of previous work indicated that the eggs of T. barbitarsis will develop and hatch in distilled water. Silver staining of the egg surface indicated sites for the passage of ions, however. No site was found on the embryo possibly for reasons of

technique. The site of larval ion excretion, as in the Culicidae, was found to be in the rectal tissue. The pupa, however, which has no passage of water through the gut, excretes ions from tissue on the dorsum of the mesothorax.

TASMANIAN ROTIFERA: AFFINITIES WITH THE MAINLAND FAUNA

Walter Koste, Russell J. Shiel & Lor Wai Tan, Botany Department & Department of Agricultural Biochemistry, Univ. of Adelaide SA

Plankton collections were taken from 100 lentic and lotic habitats in Tasmania in autumn 1984 and spring 1985. Of some 200 taxa of Rotifera identified from the collections, 189 were first records from the island, 23 new to Australasia, and seven new species. The associations of Rotifera from each habitat type are summarised, and the peculiarities of disjunct distributions are discussed. The closest affinities of the Tasmanian rotifer fauna are with tropical Australia, considerably extending the known distribution of otherwise pantropical species. There is an increasing proportion of endemic rotifers, a group long considered to be cosmopolitan; 30% of some families are confined to Tasmania and SE Australia.

THE VEGETATION OF SEAFORD SWAMP
A remnant brackish wetland on the fringe of Metropolitan Melbourne

Carol Kunert, BSc., MenvSc. Environment and Policy Technology Unit, Royal Melb. Inst. Technology

Too often degraded urban wetlands are dismissed as beyond restitution by planners and biologists alike and hence are excused from any further consideration for study or managment.

However, thanks to the foresight of local management authorities, a detailed examination of the fringing and aquatic plant communities of Seaford Swamp was undertaken as part of a broader interdisclipinary study of the swamp's ecology and management.

The vegetation survey examines the influence of environmental factors upon plant distribution and structure. It provides a comprehensive data base for future ecological studies of the swamp and suggests rehabilitation measures for enhancing the area's conservation value.

MANGANESE SPECIATION IN NATURAL AND ARTIFICIAL WATER BODIES IN THE ALLIGATOR RIVERS REGION

C.A.A. leGras[1], B.N. Noller[1] and B.T. Hart[2]

1. OSS P.O. Jabiru NT 5796 2. Water Studies Centre, Chisholm Institute of Technology, Caulfield East Vic 3145

Manganese dioxide has the potential to scavenge heavy metals, including radionuclides, from the water column and concentrate them upon precipitation. This effect is relevant to the Ranger

Uranium Mining Project, where much of the retained water has elevated levels of manganese. The coprecipitation of toxic metals with manganese dioxide needs consideration in case a release of water is permitted.

A study of manganese speciation in a number of artificial water bodies and the Magela Creek, based on filtration through membranes of different pore size, was undertaken. The major findings were: (1) nearly all the manganese was present in the 50nm and 400nm fractions, and (2) there was a high statistical correlation between the 15nm fractions, but not between any others. Two conclusion were drawn: (1) there is little likelihood that the particulate manganese results from the fine colloidal material, and (2) the finest material, with its expected high scavenging ability is unlikely to attain sufficient size and mass to precipitate during its transit time in the creek.

SEASONAL PATTERNS IN THE PLANKTON OF LAKE BURRANGORANG: A TIME SERIES ANALYSIS

Liston P., Norris R.N. and Georges A. Water Research Centre, CCAE

Time series analysis of eighteen years of limnological records from Lake Burragorang, a large temperate-zone reservoir, showed that the most important physical determinants of the phytoplankton abundance were temperature and the ratio of mixing depth to euphotic depth, whereas the most important biotic determinants were zooplankton grazing and presence of other algae. Nutrient levels did not limit phytoplankton abundance. Ideas that seasonal changes in phytoplankton abundance are determined by a hierarchy of influences (physical, chemical, biotic) were only partly supported by this study. At some times in Lake Burragorang, biotic factors had as powerful an influence on phytoplankton abundance as physical factors.

Zooplankton populations peaked in spring and although abundance was related to algal levels, temperature, turbidity and pH, these factors could not fully account for the seasonal pattern in zooplankton abundance. It is postulated that summer fish predation had a major impact on zooplankton abundance.

NATIVE FISH AS INSECT CONTROL AGENTS

Lance Lloyd, River Murray Research Unit, Dept. of Zoology, University of Adelaide

The biological control of insect pests using fish predators has seen a resurgence since the 1970's. The recognition of the environmental problems arising from physical and chemical control methods has been a major influence. This paper reviews the use of fish as mosquito control agents and draws three conclusions:

(1) The rationale for introducing fish where fish populations already exist is questionable;

(2) Exotic fish species, such as the mosquitofish (Gambusia affinis), are not necessarily more effective control agents than native species and exotics may cause ecological disturbance;

(3) Native fish species may provide viable insect control alternatives.

If fish are to be used as control agents, rigorous prior testing is imperative.

RADIOACTIVE DISEQUILIBRIA IN GROUNDWATER COLLOIDS

Richard T. Lowson and Stephen A. Short. Environ. Sci. Div., AAEC, Lucas Heights Research Establishment

Investigations have been made of the distribution of radionuclides of the uranium decay chain in the solute and colloidal phase, in the groundwater in the vicinity of some Australian uranium bodies. One of the ore bodies is located in Cretaceous gravels in the Ashburton River region, WA, the others are in Lower Proterozoic sediments in the Alligator Rivers Region, NT.

The groundwater was sampled by extended pumping and the colloid recovered using an ultrafiltrate membrane with a molecular weight cut-off of 100,000.

The groundwaters contained colloidal material retaining measurable quantities of uranium and thorium isotopes. The principal uranium isotopes U^{238} and U^{234} are predominantly in the solute phase rather than in the colloid phase. However, significant proportions of the total amounts of thorium isotopes Th^{230} and Th^{228} are associated with the colloid phase. These findings suggest that although the transport of colloids in groundwater does not contribute significantly to the migration of uranium, it contributes significantly to the transport of thorium.

THE EFFECTS OF HUMAN IMPACT ON THE MACROINVERTEBRATE COMMUNITIES OF THE THREDBO RIVER, AN AUSTRALIAN HIGH MOUNTAIN STREAM

Maryanne McKaige: Water Studies Centre, Chisholm Institute of Technology, 900 Dandenong Rd. Caulfield East, 3145

A year long investigation of the Thredbo River, an Australian high mountain stream, is reported. The main objectives of the study were to describe pristine stream conditions and to evaluate the effects of sewage effluent, and other disturbances associated with operation of the Thredbo Ski Village, on

benthic macroinvertebrate communities. Quantitative samples were collected bimonthly from seven sites representing a range of disturbed and undisturbed areas. Invertebrate communities at the pristine sites were highly diverse and abundant and were composed of the major insect and ivertebrate groups characteristic of lower altitude upland streams. Populations generally had a high proportion of species which fed on epilithic algal layers, presumably due to the relatively high insolation of the stream bed.

By contrast, sites below the various human disturbances were markedly different to those in undisturbed areas. The most pronounced changes were observed in winter (July) and summer (January). In winter benthic populations below the rubbish dump and sewage works, located within 300m, were decimated. Results suggested that toxic leachate from the dump was largely responsible for changes at both sites, since reductions occurred across almost all species and no enrichment tolerant species emerged as dominant below the sewage effluent.

In warmer months the effects of the dump were far less severe due to lower precipitation and leaching, however, the effects of organic effluent were clearly evident below the sewage effluent and below a trout hatchery further downstream. While diversity remained high, benthic population densities significantly exceeded those at other sites and had greater relative abundances of the more pollution tolerant groups such as chironomids, oligochaetes, and one or two species of Trichoptera. There was evidence of stimulation of invertebrate communities as far as 12km downstream of the sewage effluent, but it was postulated that this effect was due more to the remobilisaiton of sediment-entrained winter nutrient loads than to the direct effects of the effluent in summer.

THE DEVELOPMENT OF A TWO-DIMENSIONAL RESERVOIR MODEL

Ian Meares and Jorg Imberger, Centre for Water Research, The University of Western Australia

The use of numerically based integral reservoir models has been well documented. These models are usually based on the assumption of one-dimensionality, and as such, can only model a subset of field situations, where relatively stable conditions minimise the two-dimensional response.

A two-dimensional integral model was recently developed to overcome the limitations of the one-dimensional approach. The water body is divided into a series of vertical cells and then each cell is treated as in the one-dimensional case; the local conditions such as velocity shear and turbulent kinetic energy are modified at each step by an advection algorithm which communicates water among neighbouring cells.

This model will be described in detail and the success of the model will be illustrated with results from simulations on a simple two-layered system contained in a rectangular tank and with a constant wind stress applied to the surface.

THE WIMMERA RIVER - A DEGRADED SYSTEM?

Luisa Macmillan, Environment and Technology Policy Unit, RMIT, Melbourne

The Wimmera River, an internal drainage in north-west Victoria, has been the focus of a recent study for the Australian Heritage Commission. It provides a striking example of the many ways in which a river system can be degraded. Severe erosion and salting problems occur in the upper catchment, flow in the system is greatly diminished through water abstraction, and sewage effluent contributes to a poor water quality. Untangling the contribution of these factors to the changed condition of instream biota is a difficult yet important task, given the future likelihood of environmental flow allocations.

It would be easy to dismiss the Wimmera as 'beyond repair', but despite its generally degraded condition, it retains a number of features of high conservation value. Unlike many river systems, the terminal portion of the Wimmera is probably little affected by the gross disturbances upstream, and is of high conservation significance.

A TECHNIQUE FOR TAKING FROZEN CORES OF COARSE RIVER BED SEDIMENTS

R. Marchant, Museum of Victoria, 71 Victoria Crescent, Abbotsford, Vic. 3067

A study of the benthic fauna of the Thomson River in Victoria required a means of quantifying the depth distribution of benthic invertebrates and fine sediments (2mm in diameter): freeze-coring was chosen. Frozen cores were taken by pumping liquid CO_2 into standpipes (42mm external diameter) which had been hammered 30cm into the consolidated, coarse sediments (rocks mostly 32mm in diameter) of the river bed. The pipes were left in place for 24 hours before freezing. After 4 minutes of freezing the pipe with the core attached to the outside was extracted from the river bed using truck jacks. The resulting hollow cores averaged 10cm in diameter. Approximately 80% of the fauna was located within 10cm of the surface although animals were found to 30cm in depth. At one site during flooding the majority of the fauna was at 10-20cm. The amount of fine sediment increased steadily with depth at sites above and below a dam.

ADVANCES IN THE KNOWLEDGE OF AUSTRALIAN CHIRONOMID LARVAE SINCE 1961

Jon Martin, Genetics Department, University of Melbourne

In 1961 there was only one published description of the larva of an Australian chironomid, plus seven Western Australian species and six other Victorian species in Honours or Masters Theses. Consequently identification had to rely on keys to northern hemisphere species.

The last 25 years has seen a considerable improvement in the situation, with the larvae of many endemic genera and species now being known. Regretably much of the information is still unpublished and there are numberous larval types which are not associated with any adult (and hence with a particular species). Future work should aim at rectifying this situation.

RESPONSE OF DRIFTING GAMMARUS PSEUDOLIMNAEUS (AMPHIPODA) TO CHANGES IN PHOSPHORUS

Richard H. Norris, Water Research Centre, Canberra College of Advanced Education, PO Box 1 Belconnen ACT 2616, AUSTRALIA

D. Dudley Williams. Division of Life Sciences, Scarborough Campus, University of Toronto, 1265 Military Trail Scarborough, Ontario, M1C 1A4, CANADA

Additions of phosphorus from 40 to 1200 ug l^{-1} reduced the drift activity of Gammarus pseudolimnaeus Boisfield held in laboratory stream tanks at 12°C. In field, flow and phosphorus concentrations dropped in the stream following the spring snow-melt in Southern Ontario, subsequently the drift rates of amphipods increased with the peak in activity coinciding with the release of young. Experimental addition of phosphorus to the stream did not produce a drop in drift activity corresponding with the laboratory findings, but this may have resulted from higher temperatures and the post-reproductive state of the animals at that time.

ECOLOGICAL ROLE OF WOOD IN STREAMS

Nick O'Connor, Department of Zoology, Monash University, Clayton, Vic. 3168

Wood is an integral part of the morphology and ecology of most natural streams. Large pieces of woody debris alter the morphology of streams leading to increased physical complexity, thus creating potential habitat for many species of fish and invertebrates. In soft-bottomed lowland streams and rivers, woody material (i.e. snags) provides cover for fish and a stable substrate for many species of invertebrates. The ecological and morphological role of wood changes along the stream continuum with changes in stream size. Overseas studies

have shown that large, lowland rivers tend to contain less wood per area of channel bottom than do small upland streams (although this may be due to human activity). This may not be the situation in south-eastern Australia where lowland streams and rivers generally possess a riparian zone dominated by the river red gum (Eucalyptus camaldulensis), a species noted for its habit of shedding large limbs during hot weather. Following a review of the ecological role of wood in streams, I will present and discuss preliminary results of my own studies on the role of redgum snags in a lowland stream system in northern Victoria (Creightons Creek).

ESTIMATING LIGHT ABSORPTION BY PHYTOPLANKTON METHODS, MIXED LAYERS AND CRITICAL GROWTH VALUES

R.L. Oliver
CSIRO, Centre for Irrigation Research, Griffith

In situ estimates of algal light absorption are invariably based on chlorophyll specific extinction coefficients obtained from a linear relationship between the extinction coefficient for downwelling irradiance and chlorophyll-a concentration. This methodology is incorrect as it ignores upwelling irradiance and light scattering. A method is described which improves the estimate of algal light absorption particularly in turbid waters, and demonstrates the potential magnitude of the error in earlier estimates.

The absorption of light by algae in mixed layers is considered and data presented from Mt. Bold Reservoir which demonstrates light limitation of algal growth during deep mixing in early spring, and provides evidence for a critical value below which algal growth is light limited. This critical value is similar to that found in some marine environments and in cultures of Chlorella.

THE EXCRETION OF AMMONIA AND PHOSPHATE BY ZOOPLANKTON

Armando Padovan, Botany Department, University of Adelaide

The excretion of ammonia and phosphate by natural populations of zooplankton (Daphnia carinata and Boekella symmetrica) was measured in the laboratory. Two techniques were used. The first required animals to be isolated from their food source and the second attempted to measure excretion rates in the presence of phytoplankton. These results are presented and discussed with reference to their ecological implications.

SIZE DISTRIBUTIONAL SKEWING IN JUVENILE FRESHWATER FISH

Bryan E. Pierce RMRU, Department of Zoology, The University of Adelaide

Juvenile fish populations often display a positively skewed size distribution due to the presence of a few fast growing fry. This phenomenon, often referred to as "shooting", was readily inducable in a variety of fish (e.g., carp, goldfish, mountain galaxiid, desert goby, purple-spotted gudgeon, guppy, and various melanotaenid species). Shooting was also identified in wild populations of carp and mountain galaxiid. No evidence was found that inherent factors such as genetic superiority, a skewed hatching sequence or skewed size distribution at hatching caused shooting. For instance, when small, supposedly genetically inferior goldfish fry from an early spawning were introduced into a later spawning of slightly smaller fish from the same parents, they assumed the high growth rate of shoot fish. Various environmental influences were shown to positively influence skewing. Newly hatched fry subjected to a limited food supply develop a positively skewed size distribution prior to significant starvation-induced mortality. Once mortality begins, it primarily affects the smallest fish, thus accentuating positive skewing. This phenomenon may have important implications to genetic selection and culture of fishes and to understanding the recruitment dynamics of fish populations.

CONSEQUENCES OF STOCKING BONY BREAM IN IMPOUNDMENTS

Jim Puckridge, River Murray Research Unit, Department of Zoology, University of Adelaide

In the United States, gizzard shads (Dorosoma spp.) are a minor component of lotic fish faunas. However, they dominate the communities of warm water impoundments, and may suppress populations of commercial species. The Australian freshwater gizzard shad or bony bream (Nematalosa erebi) has a similar diet, mode of feeding, reproductive capability and growth rate to Dorosoma cepedianum, and is also widely distributed. Its potential for dominance is illustrated by its abundance in the impounded lower Murray. Proposals to introduce it to other warmwater impoundments should be treated with caution.

MECHANISMS OF DROUGHT SURVIVAL IN SOME WESTERN AUSTRALIAN FISH

B.J. Pusey, Zoology Department, University of Western Australia

The extreme south west of Western Australia is an area of high rainfall yet many of the streams and nearly all of the large peaty swamps of this area are ephemeral. Surprisingly these swamp habitats have a rich (by Australian standards) fish species assemblage. Two of the six species found here are able to aestivate (Lepidogalaxias salamandroides and Galaxiella

nigrostriata) and consequently are the first fish to appear after the onset of winter rains. The remaining species are forced to seek summer refugia within the swamps and congregate in high densities. During this period many of the fish appear to be starving and there is a high overlap in dietary preference.

Aestivation in Lepidogalaxias is similar in some respects to lungfish aestivation but there are important differences in the physiological mechanisms used to achieve oversummering. Finally Lepidogalaxias is an internal fertilizer and sperm or fertilized eggs are held with the body until the development of structures associated with laying. I suggest that this is adaptive and associated with the ability to aestivate.

ANALYSIS OF MACROPHYTE DISTRIBUTION - A LITTLE BIT OF BOOL GOES A LONG WAY

Naomi Rea, Botany Department, University of New England, Armidale 2351

Data on the initial stages of permanent changes or fluctuations in the distribution of aquatic plants is scarce. In Bool Lagoon the major change is contrary to the classic succession of a hydrosere. The spread of the fleshy leafed Triglochin procera has been at the expense of the emergent rush Baumea arthrophylla, that once occupied a greater part of the lagoon.

The distribution of aquatic vegetation and the direction in which it altered was documented by Moving Analysis of Interspecific Associations (Lange and Sparrow, 1985). The usefulness of this analysis was not only to classify species associations but to identify the intervening boundary vegetation. Interpretation of these zones and outlaying species is usually descriptive. In Bool Lagoon the character of species interactions across the major boundary identified the key species in direct conflict and their patchy distribution. This pattern inplies the influence of an ongoing disturbance. Interaction of the dominant species and their response to a nutrient resource is discussed.

A COMPARISON OF THE MACROBENTHOS OF VICTORIAN AND SASKATCHEWAN SALINE LAKES.

Brian Timms, Avondale CAE, Cooranbong 2265

In Victoria 24 lakes ranging from 1-204gl^{1} salinity were sampled in summer, while in Saskatchewan, Canada, 22 lakes ranging from 1-88gl^{-1} were studied in spring (and some in summer too). In the Victorian lakes there were 27 species of macrobenthos, the important species being the worm Antipodrilus timmsi, the ostracod Mytilocypris splendida and Australocypris robusta, the isopod, Haloniscus searlei, the amphipod Austrochiltonia subtenuis, the chironomids Procladius spp.,

Chironomus duplex and Tanytarsus barbitarsus and the snail Coxiella striata. By contrast 58 species occurred in the Saskatchewan series, with the amphipod Hyalella azteca, 7 species of chironomid and dolichopodid and ephydrid dipterans common. Diversity changed little with salinity in the Victorian lakes, but there was a significant inverse relationship in Saskatchewan. These differences are explained by different speciation scenarios in the two regions.

In both lake districts total biomass was greatest in hyposaline lakes and least in the most hypersaline sites. Saskatchewan lakes 5m deep typically had low standing crops because of the direct or indirect adverse influence of winter ice. In Victoria such shallower lakes had the greatest biomass, as the benthos of deeper lakes is inhibited by summer stagnation.

DEAR MR PLAYFAIR, TESSELLARIA IS ALIVE AND WELL

Peter Tyler and Roger Croome, Department of Botany, University of Tasmania, Box 252C, GPO, Hobart, Tasmania 7001

In which the connection between a narrow gauge railway, the world's largest tin mine, the gore of Passchendaele, and a shy Sydney cleric exploring Lismore, are outlined with the aid of a rare, glass-mantled golden orb, the delight of Paris.

THE LIFE HISTORIES OF SOME LEPTOCERID CADDISFLIES IN VICTORIA

Ros St Clair, Zoology Dept, Monash University, Clayton, Victoria 3168

The life histories of six species of leptocerid caddisflies were studied, three from an intermittent stream, two from a permanent stream, and one from a farm dam. The four Triplectides species were univoltine, usually with extended emergence periods and asynchronous development. The smaller Notalina and Leptorussa species took two years to complete development, and both species had shorter emergence periods and more synchronous development.

These results are compared with results of life history studies of other macroinvertebrates in south-eastern Australia and with results of overseas studies.

RESEARCH STRATEGY FOR WATER RESOURCES MANAGEMENT IN NEW ZEALAND

Dr M.E.U. Taylor
Water and Soil Directorate, MWD, New Zealand

The principles underlying New Zealand's water and soil conservation management are outlined and the way in which these have shaped water and soil conservation research strategy is discussed.

COLLOIDAL MANGANESE OXIDE - FULVIC ACID INTERACTIONS IN FRESHWATERS

T. David Waite, Environmental Science Division, Australian Atomic Energy Commission, Lucas Heights Research Laboratories

Manganese, a ubiquitous element in most freshwaters, exists mainly in the particulate oxidised form and exhibits unique colloidal and adsorptive properties. The transport of this element and any adsorbed species may be altered by adsorption of naturally occurring organic matter (humic and fulvic acids) with subsequent dissolution of the particulate manganese induced by this mildly reducing organic material.

Detailed studies of the interaction of a well-defined freshwater fulvic acid with a synthesised manganese dioxide are reported here. The importance of pH in determining the extent of fulvic acid adsorption is stressed, as is the effect of light in enhancing the reductive dissolution of the manganese dioxide. The equilibrium established between adsorbed and solution phase Mn(II) is also seen to be a particularly important component of the dissolution process on increasing pH. A mathematical model incorporating organic adsorption, reductive dissolution and Mn(II) adsorption to the colloid surface is found to adequately describe the obtained data.

ANALYSIS OF A LONG TERM WATER QUALITY DATA SET

David R. Welsh and Craig T. Bass; Rural Water Commission of Victoria

The Rural Water Commission of Victoria has been collecting water quality data as part of the National Water Quality Assessment Program since 1975. The stream quality network involves the monitoring of 6 parameters every month at 330 sites, and the determination of a further 18 parameters every 3 months at 100 sites.

Trends in water quality were determined by the Box-Jenkins method of time series analysis. The method highlighted the importance of the monitoring frequency to trend detection. Geographical influences on trends were shown by cluster analysis of the trend components of the data.

The ability of the water quality data to reflect catchment characteristics was evaluated by means of an impact matrix, which combined slope, geology and land use activities into a single numerical value. The monitoring frequency was also found to be an important factor when examining the ability of the network to indicate the affect of fires, floods and effluent discharge on water quality.

The paper presents the methods used to examine the long term data set and comments upon the results obtained.

AUSTRALIAN LIMNOLOGY TO 1986

W.D. Williams, Department of Zoology, University of Adelaide, GPO Box 498, Adelaide, South Australia, 5001

Perhaps the earliest Australian limnologists were Aboriginals. Certainly there are indications that they knew much about the inhabitants of Australian inland waters. Early European settlers' knowledge was less profound. Information of limnological interest accrued gradually during the nineteenth century but was largely incidental to geographical or geological observations. In the first part of the twentieth century, serious attemtps to describe the organisms of inland waters began. In part, these descriptions were by 'visitors' from Europe (eg G.W. Smith), in part by residents (eg O.A. Sayce). The pace of description increased from about 1960 and included also descriptions of physico-chemical features. A preoccupation with the descriptive features of rather than the processes within Australian aquatic ecosystems has been the predominant and predictable aspect of Australian limnology to 1986. The role of the Australian Society for Limnology (founded 1961) as a focal point for limnological endeavours and a catalyst for particular investigations should not be underestimated. In the absence of federal and state government interest in Australian limnology until 1986, the ASL provided the only means whereby scientific interest in Australian inland waters was 'visible'. The role of CSIRO journal The Australian Journal of Marine and Freshwater Research has also been critical in sustaining limnological interest.

INTER-AND INTRA-SPECIFIC LIFE HISTORY VARIATION WITHIN THE GALAXIIDAE

Paul Humphries, Zoology Department, University of Tasmania.

An analysis of galaxiid life history traits was undertaken to determine the validity of the claim by McDowall (1970) that the family exhibits two distinct life history strategies. Traits included in the analysis were : egg size, fecundity, body size and time of spawning. There is a clear distinction between diadromous and totally freshwater galaxiids - the latter type tend to be smaller, have fewer, larger eggs and spawn after winter; while the former type show the opposite set of traits. These results are compared with those from a study of intra-specific variation between landlocked and stream-dwelling forms of Galaxias truttaceus in Tasmania. The lacustrine populations of this normally diadromous species show differences in life history traits which are similar to those seen in totally freshwater galaxiids. A trend towards fewer, larger eggs is apparent, with a shift in spawning time from before to after winter. It is uncertain whether there has been any age-specific change in size.

McDowall, R.M. (1970) The galaxiid fishes of New Zealand. Bull. Mus Comp. Zool. Harr. Uni. 139 : 341-432.

GENERAL OBSERVATIONS OF ACTIVITY IN SEWAGE WASTE STABLISATION PONDS

Tim Wrigley
School of Environmental and Life Sciences, Murdoch University

The removal efficiency of the major nutrient inputs of settle sewage ie Ammonia-Nitrogen (NH_3-N), Orthophosphate-Phosphorus (PO_4-P) and Nitrate-Nitrogen (NO_3-N) in passage through a pilot scale waste stabilisation pond system was investigated.

Maximum removal of NH_3-N occured in the primary pond; smaller losses were recorded in the following three secondary ponds. PO_4-P removal was relatively small in three of the four ponds while no removal at all occurred in one pond. NO_3-N and organic matter (measured as COD) generally decreased in passage throughout the pond system. Possible mechanisms responsible for the removal of these nutrients and organic matter are discussed.

TSS (Total Suspended Solids) initially of heterotrophic origin was converted to algal biomass in all four ponds. Increases in algal biomass (measured by TSS and Chlorophyll a [Chl a]) occurred in ponds 1 and 2, while decreases in algal biomass were recorded from ponds 3 and 4. Sedimentation and grazing were primarily responsible for these decreases. Production respiration ratios (P/R) during summer indicated that pond 1 was principally heterotrophic whilst ponds 2, 3 and 4 were primarily autotrophic. During winter and spring all ponds were principally autotrophic, with winter P/R ratios generally higher than those found in spring.

IN BRIEF

HELP REQUESTED

Dear Colleague,

During the XXIIIth S.I.L. International Congress to be held in 1987 in New Zealand a special session on the "Translocation of species" is planned.

The purpose is to deal throughout with the whole problem: pro and contra, risks and unavoidable consequences, measures to be taken, etc. It should be fine to have short communications dealing with case studies and other ones giving theoretical or academic analyses as well. A difficult point is to find, in time, specialist to accept the job.

May I ask you if, among the S.I.L. members in your country, you know somebody to participate.

With many thanks in advance.

Sincerely yours

Prof. A.F. De Bont
Department Biologie
Katholieke Universiteit
Naamsestraat Sq
B-3000 - Leuven Belgium

STREAMS OF SOUTH-WEST VICTORIA - INFORMATION REQUIRED

We are currently examining streams in the south west region of Victoria for their conservation value and status. Part of the study requires collection of any invertebrate/fish/instream studies that have been undertaken - either published or unpublished.

The study area extends from the Little River in the east to the Merri River in the west, and from the coast northwards to the Great Divide including the Otway Range; and covers the Hopkins, Barwon, Corangamite, Otway Coastal and Moorabool AWRC river basins.

Studies identified to date are:

Aldenhoven 1975, Baxter 1985, Cadwallader 1981, Campbell 1981, Earl and Bennet 1984, Jackson 1984, Jackson and Williams 1980, Koehn 1984, 1985; Lalve 1985, McCarraher 1984, Morgen 1983, Morrison 1976, Renauden 1968, Sokal 1986, Williams 1975, Yugovic 1985 and Yule 1978.

If you are aware of other studies or relevant information we would love to hear from you.

Please contact Carol Kunert or Luisa Macmillan

Department Planning, Policy and Landscape
RMIT, GPO Box 2476B, Melbourne, 3001
Ph (03) 660 2226

LETTER TO THE EDITOR

Dear Editor,

For the record, may I state that, despite Ms Joan Powling's comments given wide currency at the Jubilee Congress of the Society, the dust cover of Limnology in Australia is not an illustration of my testes. Ms Powling is not in a position to state that, and has never been in any of the 49 possible positions to do so. We are just good friends, though whether that will continue to be the case, remains to be seen (like my t.).

Yours

WDW

THESIS ABSTRACT

THE ROLE OF SUSPENDED SEDIMENT IN THE TRANSPORT OF PHOSPHORUS IN FLUVIAL SYSTEMS

Bruce A. Weston, M.App.Sci thesis, July 1985, Chisholm Institute

Overseas studies have shown that association with suspended particulate matter is one of the major mechanisms by which contaminants (nutrients, toxic organics and heavy metals) are transported in aquatic systems. This thesis reports a study on the partitioning of phosphorus between particulate and filterable forms in Shepherd Creek, a minor tributary of the Yarra River, Victoria, Australia. The effects of land use, storm events and catchment characteristics are discussed in relation to phosphorus partitioning and the loads of suspended sediment and associated phosphorus exported from the catchment. The majority of the phosphorus was transported in association with suspended material during storm events. For this reason, emphasis was placed on developing methods to effectively sample streams during storm events. During most rainfall events, road runoff and remobilisation of stream bottom sediment were found to be the major sources of fluvial particulate material. Only during infrequent, intense storm events was overland runoff observed on cultivated land.

To allow the physical and geochemical properties of the exported particulate material to be assessed, gram quantities of the particulate matter were collected using a continuous flow centrifuge. The development, calibration and operation of this equipment was discussed. X-Ray diffraction and optical and scanning electron microscopy were used to identify some of the mineralogical and morphological characteristics of the suspended sediments. The elemental composition, organic matter content, surface area and particle size distribution of the samples were also measured. The phosphorus was probably associated with several components (eg hydroxyoxides, clays) of the particulate matter.

The biological availability of the particulate bound phosphorus was assessed using two chemical extractants (NaOH, $NaHCO_3$), an anion exchange resin and an algal assay technique using Scenedesmus obliquus. A substantial portion of the particulate associated phosphorus was considered to be potentially biologically available.

The loads of suspended sediment and chemically estimated "available" phosphorus exported from a largely pastured and forested catchment were found to be similar to those from an intensively cultivated catchment. This similarity was attributed to the stable, well drained, non-dispersive soil types in the catchment and to in-stream sedimentation processes. Compared with a study of phosphorus availability in the Yarra River (Sinclair 1984), the significance of the suspended sediment exported from Shepherd Creek is as a

transporting medium for phosphorus sources added downstream, rather than as a major source of biologically available phosphorus per se.

LETTER FROM ABROAD

In sparsely populated Australia, ecologists performing field experiments risk damage to equipment and facilities by vandals and/or inquisitive bushmen even on fenced-off private land. It is unwise to leave any equipment around. For example, experimental observations by the Monash University Zoology Department of a study site on the Acheron River have revealed that Coleman-Hynes hyporheos samples make excellent beer can coolers and that with expert deft manipulations they can also be used to cook sausages.

In densely populated France they appear to have the same problem. For six years a group at the Universite Claude-Bernard in Lyon, has been studying the benthos of the upper Rhône using artificial substrate samples. However, they have solved the vandal problem - to quote from a recent paper in press. "On every substrate an 18 x 7 cm zinc plate with the Laboratory References was fixed to discourage vandalism". And this worked. French vandals not only read but they defer to universities. No doubt Australian equipment collectors would treasure an "18 x 7 cm zinc plate with the Laboratory References". All sorts of uses can be made of zinc plates attached to artificial substrate samples. Possibly A.S.L.O. should run a competition - "What would you do if you found an artificial substrate sampler with an 18 x 7 cm zinc plate attached to it which bore the words - 'This sampler is owned by ..... University and is being used in a crucial experiment. Please do not disturb!'

By the shores of Lac Leman at Thonon-Les-Bains on 28-30 May 1986, L'Association Francaise de Limnologie held its 30th Congress. Thoron-Les-Bains is a resort town famous for its association with the philosopher Jean Jacques Rousseau and it is also the site of the French Institut de Limnologie.

About 180 people attended the Conference. The Conference had 9 themes - "Apports du basin versant; relations eau-sediments; Ecologie microbienne; Relations phytoplancton - Zooplankton - poissons; typologie des lacs; pollution des eaux; hydrodynamique des eaux; methodes d'etude des milieux; zoologie aquatique; etudes piscicoles; Botanique aquatique.

Having a poor understanding of fast, excited French, many papers were difficult for me to follow. For some papers; those giving a torrential stream of mathematics or with lots of graphs of things going up and other things or the same things coming down, my incomprehension was perhaps a blessing in disguise. There were some interesting papers which I could interpret. A paper on ATP levels in lake populations of phytoplankton by Dr C. Ambland of Université Clermont-Ferrand

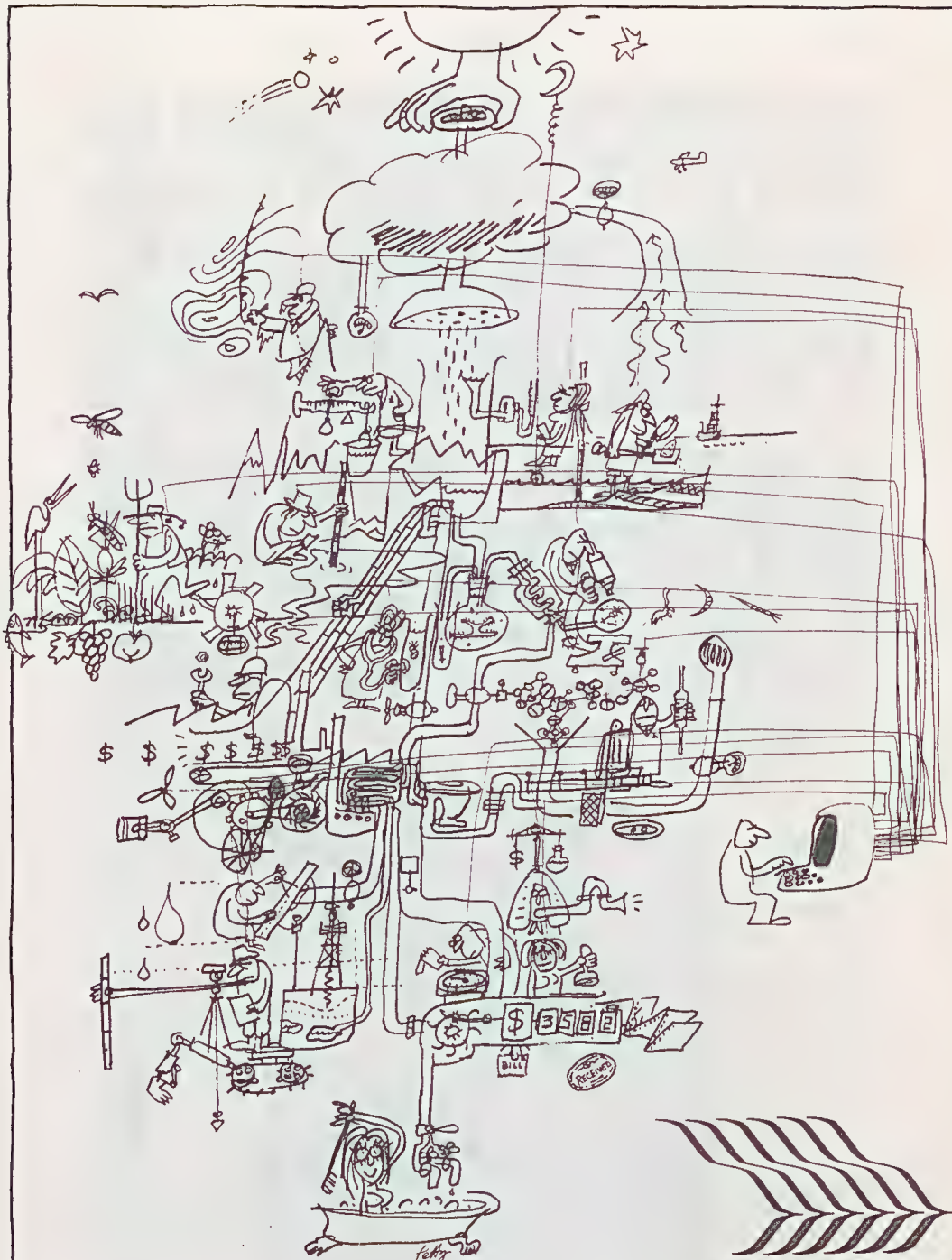
gave a fascinating account of the growth and senescence of phytoplankton populations and the possible implications of the state of the phytoplankton to zooplankton predation. A paper by G. Laeroisc provided a somewhat controversial account of phenotypic plasticity in Bosmina longirostris. It appears that the spined large form of B. longirostris is an adaptation to resist cyclopoid predation, while the small unspined form is adaptation to resist predation by larval fish. A paper by P. Marmonier and M.J. Dole gave a clear account of the importance that side arms of the Rhône River have in macroinvertebrate recruitment to the main channel. The main channel is populated by amphipods flushed out of the side arms by floods. For those interested in high technology limnology, there was a paper describing the use of the submarine "F.A. Forel" to find the breeding grounds of char in Lac Léman.

Besides 62 oral papers; 35 Poster Papers were given. Some of the exchanges I witnessed at the display of the Poster Papers reminded me of a night out at the Rob Roy Hotel in Fitzroy or a Celtic versus Rangers match. In general, Australian Limnology Conferences in their formal sessions are gentle affairs in comparison to this French Conference. Several students in discussion of their papers were offered little comfort-defenestration or the muffle furnace?

The conference concluded with a banquet of fish from Lac Léman - with an entree of roach fillets and a final main course of Salmo Saris trutta and a cruise in the mist on Lac Léman.

P.S. Lake

Life in the petri dish



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PROMOTION OF WATER INFORMATION SERVICES: A PETTY ISSUE?

STREAMLINE, Australia's national water data base, was established in 1982 to meet the needs of the Australian water industry. Several years ago, in line with developments overseas, the Australian Water Resources Council accepted that there was a need for more systematic access to information about all aspects of Australia's water resources. STREAMLINE was the result.

Establishment of the data base is only the first step. It is clear that it needs substantial promotion to ensure that those that are likely to benefit from the data base are aware of its existence and how it can help them. To achieve this, the assistance of cartoonist Bruce Petty was obtained. A reduced version of the complete poster is shown opposite. Petty was chosen because of his capacity to illustrate complex systems, the system in this case being a representation of all the subjects covered by the data base.

If you would like a copy for your organisation, please contact the nearest water library listed below.

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If you are interested in contributing to the data base in any way, please contact the STREAMLINE Co-ordination Unit on (062) 458504 (Sally Anderson) or 458252 (Elizabeth Lising).

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STREAMLINE Co-ordination Unit
Department of Resources
and Energy
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CANBERRA ACT 2601

Tel: (062) 458231

LIMNOLOGY BIBLIOGRAPHY

Here is the next installment of the Australian Limnology Bibliography. For inclusion of references, please forward titles, abstracts, reprints or citations to R. TAIT, ESSO AUSTRALIA LTD., P.O. BOX 4047, SYDNEY, N.S.W, 2001. Please keep those letters and cards rolling in.

1984:

MICHAELIS, F.B. Possible effects of forestry on inland waters of Tasmania: A Review. Environ. Conserv. 11:331-344.

YULE, C.M. Taxonomic observations on Dinotoperla (Plecoptera: Gripopterygidae) from south-eastern Australia. Aquatic Insects 6:201-216.

1985:

BRIGGS, S.V., MAHER, M.T. and TONGWAY, D.J. Dry matter and nutrient loss from decomposing Vallisneria spiralis L. Aquat. Bot. 22:387-392.

CHRYSTAL, P.J., POTTER, I.C., LONERAGAN, N.R. and HOLT, C.P. Age structure, growth rates, movement patterns and feeding in an estuarine population of the cardinal fish Apogon rueppellii. Mar. Biol. 85:185-197.

CLARIDGE, P.N. and POTTER, I.C. Distribution, abundance and size composition of mullet populations in the Severn Estuary and Bristol Channel. J. mar. biol. Ass. U.K. 65:325-335.

CLARIDGE, P.N., HARDISTY, M.W., POTTER, I.C. and WILLIAMS, C.V. Abundance, life cycle and ligulosis in the gobies (Teleostei) of the Severn Estuary. J. mar. biol. Ass. U.K. 65:951-968.

EPPLE, A., HILLIARD, R.W. and POTTER, I.C. The cardiovascular chromaffin cell system of the Southern Hemisphere lamprey Geotria australis Gray. J. Morph. 183:225-231.

HILLIARD, R.W., EPPLE, A. and POTTER, I.C. The morphology and histology of the endocrine pancreas of the Southern Hemisphere lamprey, Geotria australis Gray. J. Morph. 184:253-261.

HILLIARD, R.W., POTTER, I.C. and MACEY, D.J. The dentition and feeding mechanism of adults of the Southern Hemisphere lamprey Geotria australis Gray. Acta Zool., Stockh. 66:159-170.

POTTER, I.C. and CLARIDGE, P.N. Seasonal catches, size and meristic data for sprat, Sprattus sprattus, in the Severn Estuary. J. mar. biol. Ass. U.K. 65:667-675.

SHIEL, R.J. and KOSTE, W. Records of rotiters epizoic on cladocerans from South Australia. Trans. Roy. Soc. S.A. 109:179-180.

YULE, C.M. and JARDEL, J-P. Observations on the eggs of species of Dinotoperla (Plecoptera: Gripopterygidae). Aquatic Insects 7:77-85.

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COMING EVENTS

22-26 JUNE
American Water Works Association 1986 Annual Conference and Exposition, "Water-Key to Life" Denver, Colorado, USA Contact: AWWA International Affairs Committee, 6666 West Quincy Ave, Denver, Colorado 80235 USA.

22-29 JUNE
Nineteenth International Ornithological Congress. Ottawa, Canada. Details from: Dr Henri Ouellet, 19th Congressus Internationalis Ornithologicus, National Museum of Natural Sciences, Ottawa, Ontario, Canada KIA OM8.

22 JUNE - 9 JULY
Second International Symposium on Indo-Pacific Marine Biology. Venue: University of Guam. Details: Prof. D.H. Montgomery, Biological Sciences, Cal Poly State University San Luis Obispo, California, USA, 93407.

23-26 JUNE
Combined meeting of the American Society of Limnology and Oceanography and the Phycological Society of America, University of Rhode Island Narragansett, USA Contact: Dr C. Oviatt, Graduate School of Oceanography, University of Rhode Island, Narragansett Bay Campus, Narragansett Rl 02882-1197 USA.

7-11 JULY
First European SEM Congress, London Contact: The Administrator, The Royal Microscopical Society, 37/38 St Clements, Oxford OX4 1AJ UK.

15-16 JULY
Fifth conference on science and technology, Sydney, NSW Contact: Mr S. McKay, Secretary ANZAAS-AIST Conference, School of Biological Sciences, Macquarie University, North Ryde, NSW 2113

15-18 JULY
The behaviour of fishes University College, Bangor. Meeting jointly organised by the Fisheries Society of the British Isles and the Int. Association of Fish Ethologists. Contact: Dr J.R. Allan, School of Animal Biology, Univ. College of North Wales, Bangor, Gwynedd, LL37 2OW.

20-24 JULY
Conference on research and applications of aquatic plants for water treatment and resource recovery, Orlando, Florida, USA Contact: Dr Wayne H. Smith, Chairman, Aquatic Plants Conference Steering Committee, University of Florida, IFAS, McCarty Hall, Room G040, Gainsville, FL32611 USA

4-6 AUGUST
International symposium on drainage basin sediment delivery, Albuquerque, New Mexico, USA. Contact: Professor R.F. Hadley, Department of Geography, University of Denver, Denver C.O. 80208 USA

10-16 AUGUST
IV International Congress of Ecology. Global connections in ecological theory and practice. SUNY, Syracuse, New York. Details from: IV International Congress of Ecology, SUNY College of Environmental Science and Forestry, Syracuse, NY 13210, USA.

17-24 AUGUST
The First International Congress of Dipterology. Venue: Budapest, Hungary. Details: Dr. Laszlo Papp, Zoological Department, Hungarian Natural History Museum, Baross u. 13., Budapest, H-1088 HUNGARY.

24-29 AUGUST
Fourth International Symposium on Microbial Ecology, Ljubljana, Yugoslavia. Contact: Prof. France Megusar, Biotechnical Faculty, E. Kardej University of Ljubljana, Jamnikdrjeva 101, 61000 Ljubljana, Yugoslavia.

25-28 AUGUST
The ecology of the Australian wet tropics - Ecological Society of Australia and Australian Systematic Botany Society symposium, Brisbane, Qld Contact: Uniquest Limited, University of Queensland, St Lucia, Qld 4067

25-29 AUGUST
Third European Congress of Entomology. Netherlands Entomological Society, Amsterdam.

15-19 SEPTEMBER
Seventh international symposium on aquatic weeds: The biology and control of aquatic weeds, Loughborough, Leicestershire, UK. Organised by the European Weed Research Society and the Association of Applied Biologists. Contact: Dr Max Wade, Department of Human Sciences, Loughborough University of Technology, Loughborough, Leicestershire, LE11 3 TU, UK.

25-27 NOVEMBER
Hydrology and water resources symposium 1986 "River Basin Management" Brisbane Qld Contact: The Conference Manager, Hydrology and Water Resources Symposium 1986, The Institution of Engineers, Australia, 11 National Circuit, Barton ACT 2600

1987

26-30 JANUARY
Fifty sixth Australian and New Zealand Association for the Advancement of Science Congress, Palmerston, New Zealand. Contact: Dr M. Baxter 56th ANZAAS Congress PO Box 5158 Palmerston North, N2.

8-14 FEBRUARY
Twenty third SIL Congress, Hamilton, New Zealand, Contact: Convention Management Services, PO Box 3839, Auckland, New Zealand

16-20 FEBRUARY
Fourth International Symposium on the Interaction between Sediments and Water, Melbourne. Contact: ACTS GPO Box 1929 Canberra ACT 2601.

18-24 FEBRUARY
Fifth international conference on Ephemeroptera, Marysville, Victoria. Contact: Dr I. Campbell, Water Studies Centre, Chisholm Institute of Technology, East Caulfield, Victoria 3145.

18-24 FEBRUARY
Ninth international conference on Plecoptera, Marysville, Victoria. Contact: Dr I. Campbell, Water Studies Centre, Chisholm Institute of Technology, East Caulfield, Victoria 3145.

11-15 MAY
Third International Symposium - Toxicity Testing using Microbial Systems, Valencia, Spain. Contact: D. Liu or B.J. Dutka, Toxicity Symposium Committee Co-Chairman, NWRI PO Box 5050 Burlington, Ontario, Canada L7R4A6.

25-29 MAY
Biology in Water Management, Academic Committee of the Hungarian Academy of Sciences, Veszprem, Tolbuchin U 37 Hungary. Contact: Secretariate, Budapest VI., Rozsa F.u. 91. H-1064, Hungary.

15-20 JUNE
International Conference on Reservoir Limnology and Water Quality, Ceske Budejovice, Czechoslovakia. Contact: Dr M. Straskraba, Hydrobiological Laboratory, Inst Landscape Ecology, Czeckoslovak Academy of Science, Na Sadkach 7, 370 05 Ceske Budejovice, Czecholslovakia.

24 JULY - 1 AUGUST
XIVth International Botanical Congress, Berlin, FRG. Contact: XIVth International Botanical Congress, Botanisches Museum Berlin-Dahlem, Konigin - Luise - Strasse 6-8, D-1000 Berlin 33, FRG.

1988

AUGUST 29 - SEPTEMBER 2

First Biennial Water Quality Symposium, Banff Centre, Banff, Alberta, Canada. Contact: B.J. Dutka and D.L. Liu, Co-Chairmen Water Quality Symposia Committee, NWRI CCIW PO Box 5050 Burlington, Ontario, Canada L7R 4A6.